Summary of "Home Care Increases Hospitalization for Congestive Heart Failure Patients in Alberta"

By Y. Jin, H. Quan, B. Cujec, and D. Johnson

Purpose

Congestive heart failure is the most common diagnosis for hospital admission in many industrialized countries. The substitution of home care for acute hospital care has the potential of decreasing the cost of care as hospital admissions account for a substantial proportion of total costs. In this study, the association of home care before admission and after discharge for newly diagnosed congestive heart failure was assessed with the cost and duration of hospitalization, re-admission rates, and mortality.

Approach

Five Alberta administrative health service databases were used to obtain data between April 1, 1995 to March 31, 2000.

Key Findings

The following are the key findings:

- 13,283 patients were hospitalized for congestive heart failure during the study period. Before admission to hospital, sixty-two percent were living at home; twenty-eight percent were living at home and receiving home care; and ten percent were residents of a continuing care facility (long term care, seniors' lodges, auxiliary hospital).
- Patients receiving home care before hospitalization had higher in-hospital mortality (10.8 percent) compared to those not receiving home care (8.0 percent).
- Patients receiving home care before and after hospitalization had longer hospital stays and were more likely to be re-admitted to hospital after initial discharge compared to those not receiving home care.
- Seventy-eight percent of hospital survivors who received home care prior to admission also received these services after hospital discharge and an additional twelve percent were discharged directly into a continuing care facility.
- Hospitalization for congestive heart failure did not increase with age for seniors residing in long-term care but did increase with age for seniors living at home (with or without receiving home care before hospitalization).

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Conclusions

This study demonstrated three main findings:

1. Home care was provided to thirty-three percent of patients with congestive heart failure before hospitalization and about forty-five percent after hospitalization;
2. Home care was provided to those most ill; and
3. Home care for those residing at home was associated with an increased rate of hospitalization in the very old compared to long-term care residents of the same age.

The use of home care is growing in Alberta as demonstrated in terms of a twenty percent increase in expenditures over the five-year time span of this study. Home care direct expenditures were much lower than hospital expenditures ($4.5 million dollars versus $60 million) for newly diagnosed congestive heart failure patients.

For More Information

Copies of the report are available from the

Alberta Centre for Health Services Utilization Research

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- at http://www.health.gov.ab.ca/system/key/Research/achsur_reports.html

Alberta Centre for Health Services Utilization Research

The Alberta Centre for Health Services Utilization Research is a joint initiative between the University of Alberta and the University of Calgary, funded by Alberta Health and Wellness. The Centre conducts studies of how health services are used and delivered to inform health policy development and management of health services delivery.

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Home Care Increases Hospitalization for Congestive Heart Failure Patients in Alberta

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SUMMARY

We describe home care both before and after hospitalization for patients with congestive heart failure and its impact on the rate and duration of hospitalization, readmissions, and mortality. We used administrative hospital and home care data from Alberta, Canada between the dates of April 1, 1995 to March 31, 2000. Of 13,283 patients hospitalized for congestive heart failure, sixty-two percent were living at home: twenty-eight percent were living at home with home care; and ten percent were residents of a continuing care facility (long term care, seniors' lodges, auxiliary hospital) before admission. Patients receiving home care before hospitalization had higher adjusted in-hospital mortality (10.8 percent, 95 percent CI 10.1 - 11.5 percent) and one-year mortality (26.8 percent, 95 percent CI 25.6 - 28.0 percent) compared to those not receiving home care (8.0 percent, 95 percent CI 7.4 - 8.8 percent for in-hospital mortality and 22.0 percent, 95 percent CI 21.0 - 22.9 percent for one-year mortality). Patients receiving home care before and after hospitalization had longer crude and adjusted length of hospital stays and were more likely to be readmitted to hospital after initial discharge compared to those not receiving home care.

Seventy-eight percent of hospital survivors who received home care prior to admission also received these services after hospital discharge and an additional twelve percent were discharged directly into a continuing care facility. Hospitalization for congestive heart failure did not increase with age for seniors residing in long term care but did increase with age for seniors living at home (with or without receiving home care before hospitalization).

This study demonstrated four main findings:

1. Home care was provided to thirty-three percent of patients before hospitalization and about forty-five percent after hospitalization for congestive heart failure;
2. Home care was provided to those most ill;
3. Home care for those residing at home was associated with an increased rate of hospitalization in the very old compared to long term care residents of the same age; and
4. Those receiving home care were treated less aggressively in hospital.

The use of home care is growing in Alberta as demonstrated in terms of a twenty percent increase in expenditures over the five-year time span of this study. Home care direct expenditures were much lower that hospital expenditures ($4.5 million versus $60 million) for incident congestive heart failure patients.

We concluded that home care before and after hospitalization for congestive heart failure was provided to sick seniors who stayed in hospital longer, were readmitted more often, and had higher mortality than those not requiring home care. Home care for those living at home increased the rate of initial hospitalization for congestive heart failure in seniors seventy-five years and over when compared to those residing in long term care.

INTRODUCTION

The provision of health care support services in the home is now considered an integral part of the Canadian medical care system [1-3]. Home care has three objectives: maintaining the functionally impaired in their homes, preventing deterioration of existing function in the home, and substituting for acute care [4, 5]. Congestive heart failure is the most common diagnosis for hospital admission in the United States [6, 7] and other industrialized countries [8-13]. The substitution of home care for acute hospital care has the potential of decreasing the cost of care as hospital admissions account for a substantial proportion of total costs [14]. Multidisciplinary home-based interventions have been shown to decrease the need for subsequent hospital care in congestive heart failure patients [15-18]. In a general geriatric population, restorative home care but not usual home care reduced health service utilization [18]. In this study, using administrative data in one Canadian province, from April 1, 1995 to March 31, 2000, we assessed the association of home care before admission and after discharge for newly diagnosed congestive heart failure with the cost and duration of hospitalization, readmission rates, and mortality.

METHODS

Five administrative health service databases were used and the analysis was done within the protected environment of Alberta Health and Wellness, which is governed by provincial legislative guidelines on the confidentiality of health information.

1. Canadian Institute for Health Information's (CIHI) Inpatient Discharge Abstract Database (DAD) for the province of Alberta for fiscal years 1993/1994 to 2000/2001,
2. Alberta Health Insurance Plan Registry File for fiscal years 1995/1996 to 1999/2000,
3. Alberta Home Care File for fiscal years 1994/1995 to 1999/2000,
4. Alberta Physician Claims Assessment System Database for 1993/1994 to 1999/2000, and
5. Alberta Long Term Care File for fiscal years 1996/1997 to 1998/1999.

Study Population:

Inclusion Criteria:

Congestive heart failure (CHF) was defined using the fifteenth International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM 428.x, 398.91, 402.x1, 404.x greater than 0, 514.x, 518.4, and 425.9) in the most responsible diagnosis field of the CIHI DAD hospital abstract [19, 20].

Exclusion Criteria:

1. Not an Alberta resident,
2. Age < 20 or age > 105,
3. Not admitted to an Alberta acute care facility,
4. No hospitalization for congestive heart failure (as the most responsible diagnosis) during the two years prior to index encounter,
5. No previous internal medicine specialist consultation claim (CPX 03.x) [21] for congestive heart failure (defined as for hospitalizations) as the most responsible diagnosis during the two years prior to index encounter, and
6. No duplicate separations within the five study years.

Home Care:

Identified congestive heart failure cases were merged with the home care databank using an anonymous personal identifier. Service hours, costs, and providers for home care during the sixty days prior to hospital admission and sixty days after hospital discharge were extracted. Home care was either received at home or in a continuing care facility (i.e. seniors lodge, auxiliary hospital, long term care or other continuing care institution).

Covariates:

Patient Characteristics:

1. Age (20 to 49, 50 to 64, 65 to 75, 75 to 84, and 85 and over),
2. Sex (female versus male),
3. Year of congestive heart failure separation,
4. Region of residence (seventeen health regions in Alberta were grouped into two metropolitan regions, Calgary, Edmonton and one non-metropolitan region),
5. Export (admission to a hospital located in a region not within region of residence),
6. Resident of continuing care prior to hospital admission, and
7. Resident of continuing care after hospital discharge.

Comorbidity:

The seventeen comorbidities that constitute the Charlson index [22, 23] were defined using Deyo's coding algorithm and the fifteen supplemental diagnosis fields in the CIHI DAD hospital abstract. The Charlson comorbidities were aggregated into none, one, two or more of the individual conditions Polanczyk's comorbidities [24] were defined as:

1. Anemia (ICD-9-CM 280.xx to 285.xx),
2. Hyponatremia and other electrolyte disturbance (ICD-9-CM 276.x),
3. Coronary artery disease (ICD-9-CM 411.xx, 413.xx, 414.xx),
4. Hypertension (ICD-9-CM 401.xx to 405.xx),
5. Valvular heart disease (ICD-9-CM 394.xx to 398.xx, 424.xx),
6. Ventricular arrhythmia (ICD-9-CM 427.4x, 427.5x, 427.6x), and
7. Hypotension and shock (ICD-9-CM 458.xx, 785.5x).

We also recorded:

1. Transferred to another acute care hospital (all outcomes attributed to first hospital contact),
2. Special care unit admission (hospital defined), and
3. Cardiac catheterizations (ICD-9-CM 37.21, 37.22, 37. 23: CPX 48.02, 48.03, 48.09 excluding suffix eight cancelled surgery). A severity score [24] was defined and assigned to each patient using the following weighting method: one point per decade of age greater than forty years and two points for each of transferred admission, cerebral vascular disease, chronic obstructive lung disease, hyponatremia, other electrolyte disturbance, metastatic disease and four points for moderate to severe renal disease and six points for ventricular arrhythmia, mild liver disease, or malignancy and thirteen points for hypotension or shock.

Hospital Volume:

At the time of this study, an autonomous regional board in each of seventeen health regions administered all Albertan hospitals. Nearly all of the three million residents of Alberta enrolled in the public health care insurance plan reside in one of the seventeen health regions. Alberta hospitals admitting congestive heart failure patients were categorized into five groups on the basis of the total number of congestive heart failure separations between April 1, 1994 until March 31, 1999 and geographic location:

1. Rural hospitals were based on the fiftieth percentile volume in rural areas: Seventy-seven hospitals had less than two hundred cases and twenty-five hospitals had 204 to 646 cases,
2. Regional hospitals (five) located in one of the five non-metropolitan regional health care cities had 238 to 646 cases,
3. Metropolitan hospitals (six) located in the metropolitan health region of Calgary and Capital without angiography capability had 327 to 2,199 cases, and
4. Metropolitan hospitals (three) located in the metropolitan health regions of Calgary and Capital with angiography capability had 1,793 to 2,700 cases.

Calculating Age-Specific Hospitalization (Death Plus Discharge) Rates:

The yearly age-specific (65 to 75, 74 to 84, 85 and over) congestive heart failure separations rates and ninety-nine percent confidence intervals of incident hospitalization and physician visits to patients not previously hospitalized were calculated for April 1, 1997 to March 31, 2000. Physician visits were defined as the first consultation claim (CPX 03.x)[21] for congestive heart failure (defined as for hospitalizations) during April 1, 1997 to March 31, 2000 and the absence of previous hospitalizations or physician claims in the two preceding years. All those that received any home care service within any of the three years that separations occurred defined the population for home care. The long term care population was determined by any census registration annually done in August. The long term census did not include those residing in senior's lodges or other types of continuing care facilities which were included in the continuing care population defined by hospital abstract data. Long term residents are one constituent of continuing care who did not receive home care services. The remaining senior population was defined in each year by all those sixty-five years of age and older registered in the Alberta Health and Wellness insurance plan and who were not classified as being long term care recipients or home care recipients.

Congestive Heart Failure Outcomes:

Length of Stay:

Length of stay was calculated as days between discharge and admission date. Transfers between different hospitals were attributed to the index admission and cumulative hospital length of stay calculated for an episode of care. Discharges and admissions within twenty-four hours to the same hospital were counted as separate admissions. Length of stay in regressions are restricted to those discharged alive.

Hospital Costs:

Inpatient costing per resource group number (RGN – an Alberta refinement of Diagnosis Related Groups) was calculated using the provincially approved methodology as set forth by the Provincial Costing Project and in accordance with the Provincial and National Management Information Systems guidelines [25, 26]. Total costs combine allocation and assignment of all direct and indirect costs associated with an inpatient encounter from the time a patient is admitted to the hospital to the time they are discharged. All costs per RGN were estimated using 1998/1999 costs and assumed similar for all the study years. All costs for episode of hospital care were attributed to the index separation. The quality of the data reporting of costs in Alberta has been highly ranked by the Canadian Institutes for Health Information [27]. As such, the methodological issues that arise around collection of cost data in the United States [28], in part due to the use of prices rather than costs, and for centres in Canada which cost admissions on the basis of "case-mix grouping" do not arise with the majority of the cost data considered in this analysis.

Home Care Costs:

Attributed costs to home care include patient service hours only and exclude travel times, which are non-attributable program costs. Home care service costs are not standardized between health regions. All amounts were expressed in constant dollars in the year 1998/1999.

Sixty-Day Readmission to Hospital:

First readmission to any acute care hospital within sixty days for those alive at the time of hospital discharge for congestive heart failure (excluding in-hospital deaths and those who did receive home care prior to readmission).

Mortality (One Year From Day of Admission):

The vital statistics declaration of death database was merged with the Alberta Health and Wellness Premium Registry databank in order to determine de-registration from the plan. One-year mortality was deaths after date of admission but excluded in-hospital deaths.

STATISTICS

Bivariate and multivariate comparisons were done by chi-square and differences in variance as appropriate. Adjusted mortality and readmission rates were calculated using logistic regression and observed to expected ratios. Adjusted length of stay and hospital costs per day were calculated using multiple regression and least-square means. Covariates used for multiple regression adjustment included patient characteristics, severity of illness, comorbidity, and hospital volumes. In the analysis of length of stay, hospital costs, and readmission, in-hospital deaths were excluded. Modeling used SAS (Version 6.12) [SAS Institute Inc. Cary, NC 2000] and significance was defined as $p < 0.05$.

RESULTS

There were 13,283 patients hospitalized for newly diagnosed congestive heart failure from April 1, 1995 until March 31, 2000 (Table 1). This represents fifty percent of the 26,782 total admissions for congestive heart failure during the study period. Patients admitted to hospitals predominately originated from home (about ninety percent) and survivors returned to home on discharge (about eighty-seven percent). Overall, 33.4 percent of patients received home care prior to hospitalization and 45.3 percent received home care after hospitalization. These proportions using home care were relatively constant throughout the study period. Total hospital and home care costs increased by two percent and thirty-three percent respectively during the five study years.

Recipients of home care before or after admissions were older and more likely to be women compared to those not receiving home care (Table 2). Seniors age eighty-five years and over constituted about a third of home care recipients. Those receiving continuing care services were also more likely to receive home care before and after hospitalization for congestive heart failure. About seventy-eight percent of those that received home care prior to hospitalization also received home care post hospitalization (Figure 1). An additional twelve percent of patients that received home care prior to hospitalization were discharged to a continuing care facility. Metropolitan residents were as likely as non-metropolitan residents to receive home care before and after hospitalization.

As demonstrated in Table 3, patients receiving home care before or after hospitalization had more comorbidity and greater severity of disease for the incident diagnosis of congestive heart failure. Those receiving home care before or after hospitalization were less likely to receive special services such as intensive/coronary care and cardiac catheterizations. The age specific hospitalization rates for those residing in long term care and at home (with and without receiving home care) are demonstrated in Figure 2a. The overall highest rate of hospitalization was in those receiving home care. Hospitalization rates significantly increased from those aged sixty-five to seventy-four years to those aged eight-five and years with home care (12.6 [ninety-nine percent CI 9.9, 15.4] to 37.4 [ninety-nine percent CI 32.4, 42.4] per 1,000) and without home care (2.9 [ninety-nine percent CI 2.6, 3.3] to 19.0 [ninety-nine percent CI 15.9, 22.2] per 1,000). Hospitalization rates were similar in those aged sixty-five to seventy-four and those aged eighty-five and for long term care residents (7.1 [ninety-nine percent CI 1.3, 12.9] to 8.8 [ninety-nine percent CI 5.6, 12.0] per 1,000). Physician first visit rates for congestive heart failure significantly increased from those aged sixty-five to seventy-four years to those aged eighty-five and over with home care (35.0 [ninety-nine percent CI 30.6, 39.5] to 82.0 [ninety-nine percent CI 74.8, 89.2] per 1,000) and without home care (13.8 [ninety-nine percent CI 13.0, 14.5] to 59.6 [ninety-nine percent CI 54.1, 65.1] per 1,000). Physician first visit rates for congestive heart significantly increased in those aged sixty-five to seventy-four to those aged eighty-five and older for long term care residents 30.4 [ninety-nine percent CI 18.6, 42.3] to 63.3 [ninety-nine percent CI] 54.8, 71.7 per 1000). Severity of congestive heart failure significantly increased with age ($p < 0.000$). The number of comorbidities was significantly greater ($p < 0.000$) in those residing in long term care (Table 4).

Table 5 shows the services that comprised home care. A home support aid was utilized in fifty-nine percent of home care recipients before hospital admission and fifty percent of home care after hospital discharge. Professional nursing care (nurse or licensed practical nurse) was utilized in ninety percent of home care recipients before hospital admission and ninety-three percent of home care after hospital discharge. In most home care recipients before and after hospitalization, home support aid was the major service received. The direct costs of home care in the sixty days after hospitalization were on average similar to the cost of one hospital day (i.e. about $460 versus range from about $300 to $500).

Unadjusted and adjusted outcome measures (Table 6) demonstrated similar results. Adjusted and unadjusted length of stay was longer in those receiving home care before and after hospitalization. The unadjusted mortality demonstrated a stepwise increase for both in-hospital and one-year mortality, in those receiving no home care, to those receiving home care, and finally, to those residing in continuing care (Figure 1). Adjusted mortality was higher in those that received home care before or after hospital admission. Adjusted sixty-day readmissions were greater in those receiving home care before or after hospitalization. Adjusted daily hospital costs were significantly less for

those receiving home care before and after hospitalization, however the total hospital costs were similar.

DISCUSSION

This study demonstrated four main findings:

1. Home care was provided to thirty-three percent of patients before hospitalization and about forty-five percent after hospitalization for congestive heart failure;
2. Home care was provided to those most ill;
3. Home care for those residing at home was associated with an increased rate of hospitalization in the very old compared to long term care residents of the same age; and
4. Those receiving home care were treated less aggressively in hospital.

The use of home care is growing in Alberta as demonstrated in terms of a twenty percent increase in expenditures over the five-year time span of this study. Home care direct expenditures were much lower that hospital expenditures ($4.5 million versus $60 million) for incident congestive heart failure patients.

We noted differences in the process of care for seniors residing at home compared to seniors residing in continuing care. The most striking difference was the constant rate of hospitalization for seniors at all ages residing in long term care. Seniors living at home (with or without receiving home care) had an increasing rate of hospitalization. The lower hospitalization rate for seniors living in a long term care was not explained by greater severity of illness or comorbidity. Physician visits for congestive heart failure varied by age. The first physician visit, in which the diagnosis congestive heart failure was made, increased with age regardless of residence. However, in the age group eighty-five and, over physician visits for long term care residents were less than those living at home and receiving home care.

This study suggests that home care accentuated the use of initial hospitalization and physician visits for congestive heart failure in a population of elderly persons aged eighty-five and over who did not live in a long term care facility. Home care supplemented by acute care appears to be a substitute for continuing care services. Some resident may have avoided hospitalization because they were treated in the long term care facility. The implications for health policy is that, in the rapidly growing eighty-five and over group, the frequency of hospital admissions and readmissions will be increased for those residents receiving home care compared to long term care.

In Canada, six provinces have legislation with respect to home care and these government-sponsored programs are provided by a mix of public employees and contracted services [29]. In the United States, home care services have increased more

than other service paid by Medicare [30]. Home care is composed of care, which is primarily medical in nature and delivered by health professionals and home support including homemaking and personal care [31]. Home care provided in Alberta is composed of both these types of services and, both nursing care and home support were the provided for those admitted for congestive heart failure. The type of home care provided may be an important consideration when home care substitution for other types medical services is being assessed [16, 17]. Other outcomes of care such as health-related quality of life may also be improved with home interventions which were not measured in this study [32].

In conclusion, home care is appropriately provided to the "old and frail" before and after hospitalization for congestive heart failure. Given the high mortality rate, home care may act as palliative care for some in the last months of life [34, 35]. This study suggests that home care accentuated the use of acute care for incident cases of congestive heart failure in the growing age group eighty-five and over [33]. Other studies have demonstrated that home care users are more likely to use other health care services [36]. More rigorous accounting for total costs and benefits of home care versus institutional care are warranted. Future studies that test the usefulness of home support should consider the 'hand-offs' between acute hospital care, long term care, and home care.

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FIGURE LEGEND

Figure 1

Flow diagram illustrating the patients with congestive heart failure who received home care both before and after hospitalization. Flow Diagram of Patient Location Prior to Admission and Post Discharge

Figure 2a

Comparison (ninety-nine percent confidence interval) of long-term care, home care, and no home care age-specific hospitalization rates for incident diagnosis of congestive heart failure from April 1, 1996 to March 31, 1999. We restricted our contrasts to the ages of most long-term care residents.

Figure 2b

Comparison (ninety-nine percent confidence interval) of long-term care, home care, and no home care age-specific initial physician visit rates for diagnosis of congestive heart failure from April 1, 1996 to March 31, 1999. We restricted our contrasts to the ages of most long-term care residents. The first visit was defined for patients who had no previous (past two years) hospitalizations in an acute hospital or physician visits (past two years) for congestive heart failure.

Figure 1a – Prior to Hospitalization (N = 13,283)

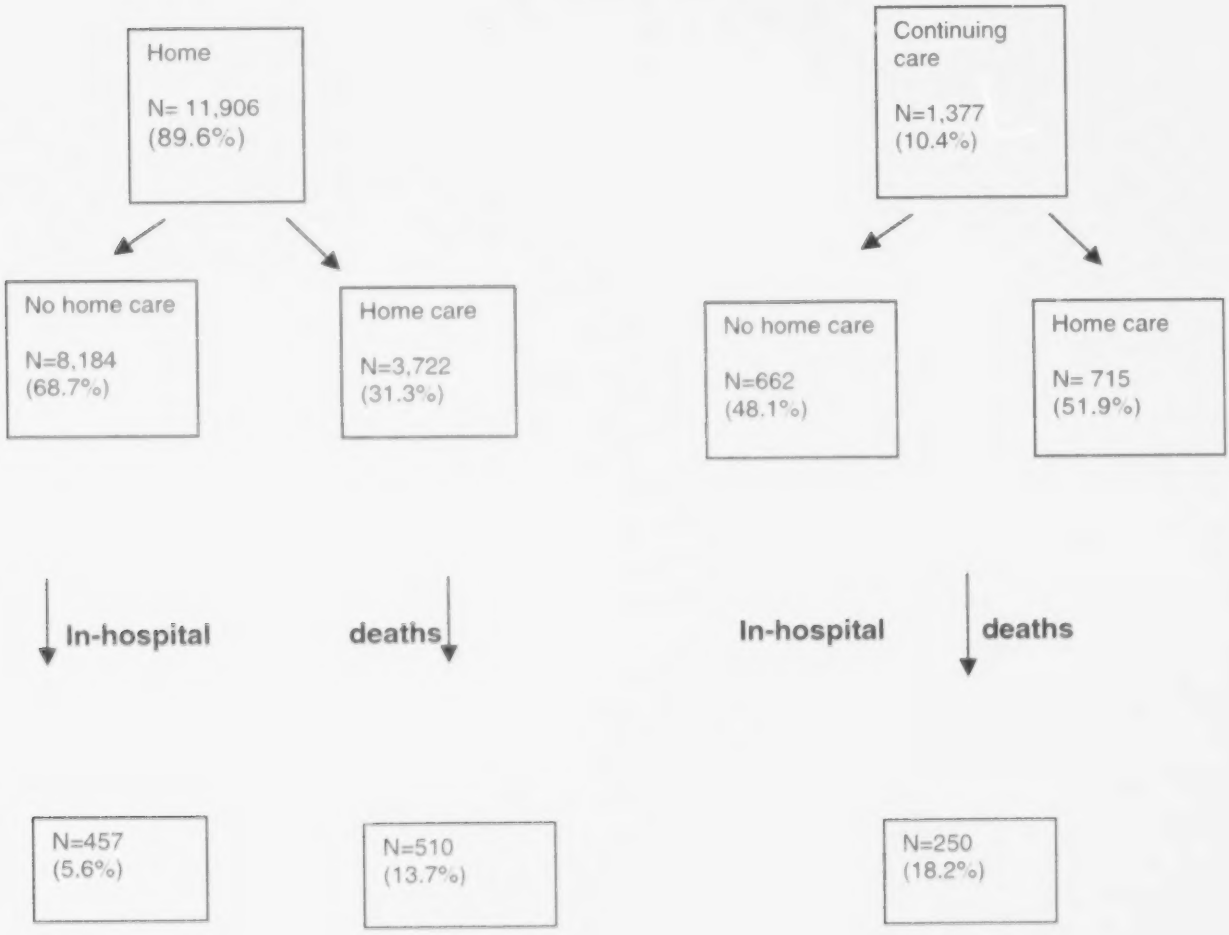

Figure 1b – Post Hospitalization Home Care

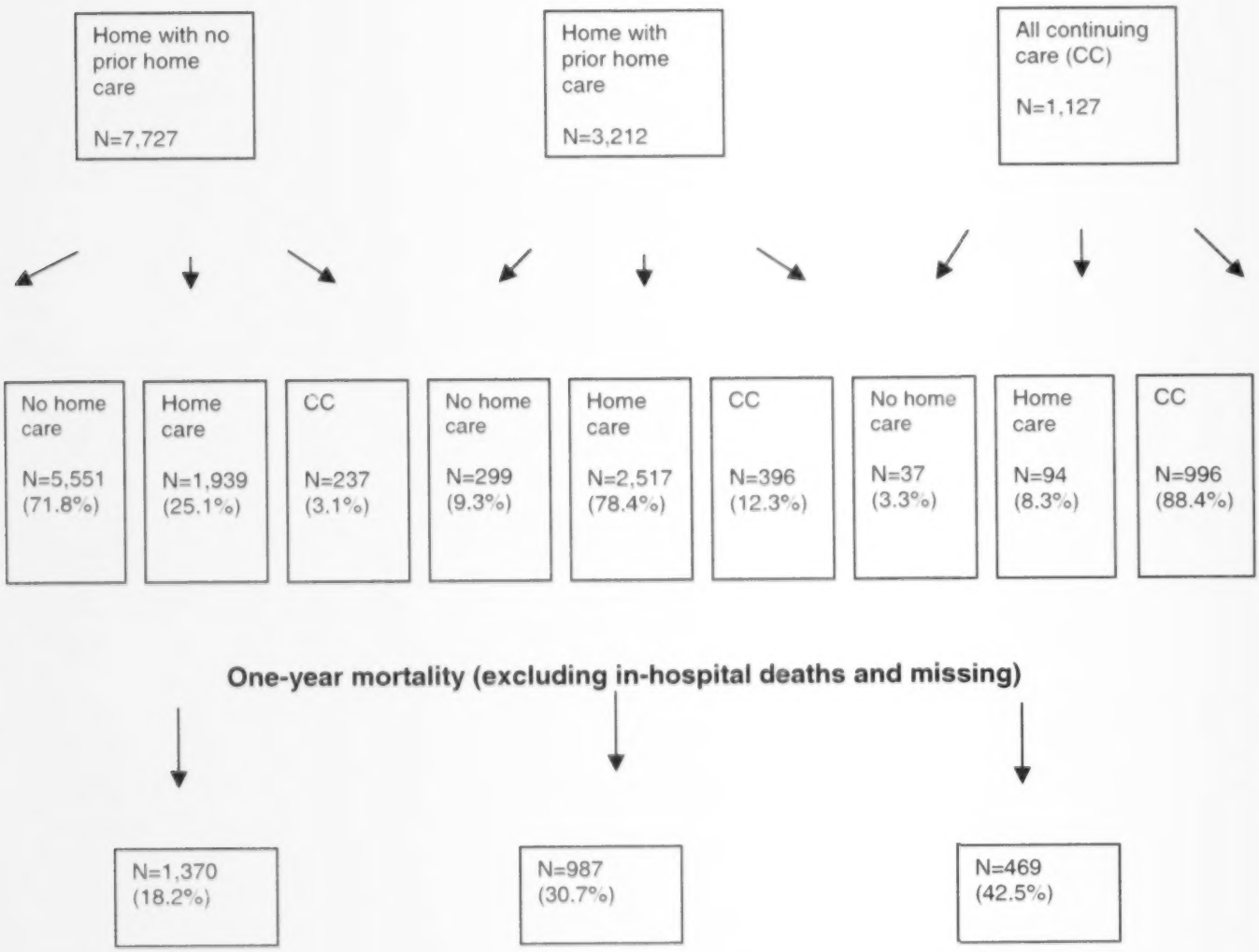

Figure 2a – Age-Specific Hospitalization Rates

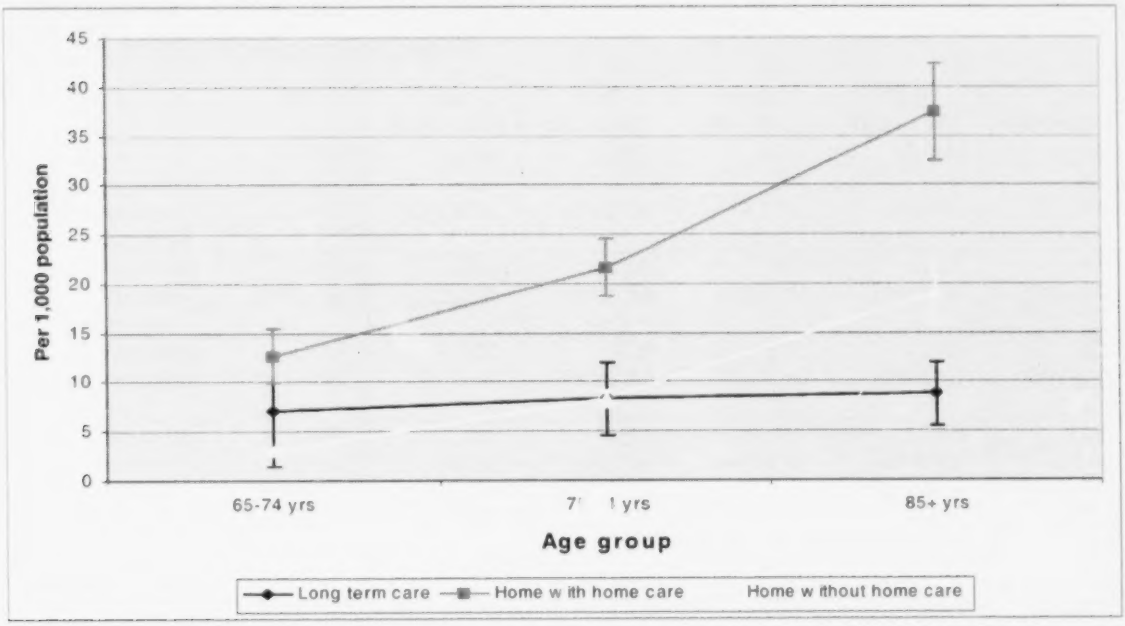

Figure 2b – Age-Specific Initial Physician Rates

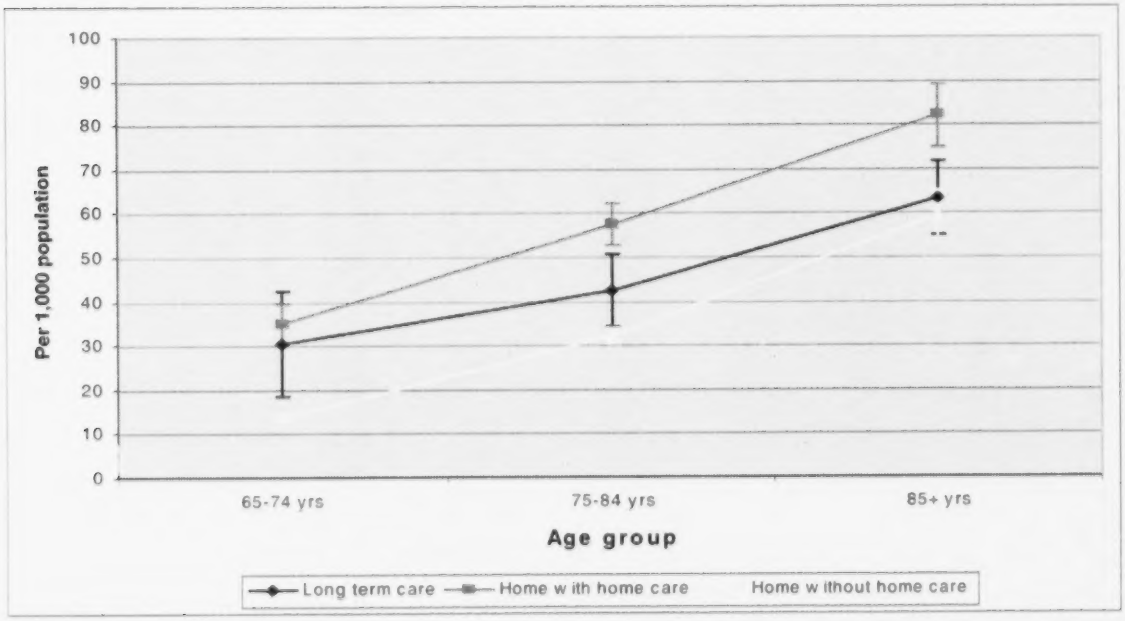

Table 1 – Utilization of Home Care in Patients (Number and Percent) Hospitalized for Newly Diagnosed Congestive Heart Failure in Alberta During 1995/1996 to 1999/2000

	All	Year 1995-1996	Year 1996-1997	Year 1997-1998	Year 1998-1999	Year 1999-2000
Patients	13,283	2,688	2,787	2,765	2,469	2,574
Patients receiving continuing care before discharge	1,377 (10.4 %)	306 (11.4 %)	280 (10.0 %)	267 (9.7 %)	234 (9.5 %)	290 (11.3 %)
Patients receiving continuing care after discharge [1]	1,629 (13.5 %)	313 (12.7 %)	296 (11.7 %)	311 (12.4 %)	244 (11.0 %)	465 (19.7 %)
Patients receiving home care before discharge	4,437 (33.4 %)	850 (31.6 %)	923 (33.1 %)	916 (33.1 %)	868 (35.2 %)	880 (34.2 %)
Patients receiving home care after discharge [1]	5,462 (45 %)	1,080 (44 %)	1,131 (44.9 %)	1,151 (45.9 %)	1,036 (46.6 %)	1,064 (45 %)
Total hospital costs (in 1,000 dollars)	$60,402	$11,950	$12,509	$12,246	$11,470	$12,227
Home care costs in the sixty days before and after hospitalization (in 1,000 dollars)	$4,583	$800	$957	$960	$904	$962

[1] Excludes in-hospital death

Table 2 – Characteristics of Patients (Number and Percent) Hospitalized With Newly Diagnosed Congestive Heart Failure in Alberta During 1995/1996 to 1999/2000

	Patients receiving home care before discharge n = 4,437	Patients receiving no home care before discharge n = 8,846	Patients receiving home care after discharge [1] n = 5,462	Patients receiving no home care after discharge [1] n = 6,604
Females	2,747 (61.9 %)	4,057 (45.9 %)	3,245 (59.4 %)	2,921 (44.2 %)
Age (Years)				
20 to 49	42 (0.9 %)	417 (4.7 %)	81 (1.5 %)	360 (5.5 %)
50 to 64	238 (5.4 %)	1,370 (15.5 %)	349 (6.4 %)	1,205 (18.2 %)
65 to 74	678 (15.3 %)	2,356 (26.6 %)	1,003 (18.4 %)	1,867 (28.3 %)
75 to 84	1,759 (39.6 %)	3,168 (35.8 %)	2,276 (41.7 %)	2,170 (32.9 %)
85 and over	1,720 (38.8 %)	1,535 (17.4 %)	1,753 (32.1 %)	1,002 (15.2 %)
Mean age (std)	80.8 (9.8)	73.5 (12.3)	79.2 (10.1)	72.2 (12.6)
Metropolitan resident (Calgary or Edmonton)	1,717 (38.7 %)	3,816 (43.1 %)	2,312 (42.3 %)	2,693 (40.8 %)
Exported from home region	280 (6.3 %)	710 (8.0 %)	357 (6.5%)	558 (8.4 %)
Resident of continuing care prior to admission	715 (16.1 %)	662 (7.5 %)	602 (11.0 %)	525 (7.9 %)
Resident of continuing care after discharge	914 (23.9 %)	709 (8.6 %)	912 (16.7 %)	717 (10.9 %)
Hospital Size				
Rural; less than 200 cases / year	1,082 (24.4 %)	1,622 (18.3 %)	1,197 (21.9%)	1,276 (19.3 %)
Rural; 204 to 646 cases / year	1,036 (23.3 %)	1,773 (20.0 %)	1,173 (21.5%)	1,396 (21.1 %)
Regional	509 (11.5 %)	1,308 (14.8 %)	625 (11.4 %)	1,005 (15.2 %)
Metropolitan without angiography	964 (21.7 %)	2,222 (25.1 %)	1,279 (23.4 %)	1,616 (24.5 %)
Metropolitan with angiography	846 (19.1 %)	1,921 (21.7 %)	1,188 (21.8 %)	1,311 (19.9 %)

[1] Exclude in-hospital deaths

Table 3 – Newly Diagnosed Congestive Heart Failure Patient Comorbidity, Severity of Illness, and Special Procedures (Number and Percent) During 1995/1996 to 1999/2000

	Patients receiving home care before discharge n = 4,437	Patients receiving no home care before discharge n = 8,846	Patients receiving home care after discharge [1] n = 5,462	Patients receiving no home care after discharge [1] n = 6,604
Comorbidity				
None	1,444 (32.5 %)	3,176 (35.9 %)	1,862 (34.1 %)	2,490 (37.7 %)
One	1,650 (37.2 %)	3,385 (38.3 %)	2,027 (37.1 %)	2,581 (39.1 %)
More than one	1,343 (30.3 %)	2,285 (25.8 %)	1,573 (28.8 %)	1,533 (23.2 %)
Mean (std) comorbidity	1.1 (1.0)	1.0 (1.0)	1.0 (1.0)	0.9 (0.9)
Severity				
Anemia	793 (17.9 %)	1,238 (14.0 %)	916 (16.8 %)	861 (13.0 %)
Electrolyte disturbance	464 (10.5 %)	772 (8.7 %)	555 (10.2 %)	442 (6.7 %)
Coronary artery disease	1,568 (35.3 %)	3,283 (37.1 %)	1,922 (35.2 %)	2,429 (36.8 %)
Hypertension	1,188 (26.8 %)	2,603 (29.4 %)	1,575 (28.8 %)	1,924 (29.1 %)
Valvular heart disease	509 (11.5 %)	1,566 (17.7 %)	841 (15.4 %)	1,091 (16.5 %)
Ventricular arrhythmia	137 (3.1 %)	307 (3.5 %)	140 (2.6 %)	165 (2.5 %)
Hypotension and shock	97 (2.2 %)	146 (1.7 %)	111 (2.0 %)	81 (1.2 %)
Severity score (mean, std)	6.7 (3.4)	5.6 (3.2)	6.4 (3.2)	5.2 (2.9)
Transferred to another acute care hospital	50 (1.1 %)	125 (1.4 %)	76 (1.4 %)	72 (1.1 %)
Intensive / coronary care unit admission	564 (12.7 %)	1,925 (21.8 %)	839 (15.4 %)	1,387 (21.0 %)
In-hospital cardiac catheterizations	137 (3.1 %)	1,101 (12.4 %)	316 (5.8 %)	909 (13.8 %)

[1] Exclude in-hospital death

Table 4 – Comparison of Long Term Care, Home Care, and no Home Care Age-Specific Comorbidity and Severity for Newly Diagnosed Hospitalized Congestive Heart Failure From April 1, 1996 to March 31, 1999

Patients with incident cases of congestive heart failure	Congestive Heart Failure Comorbidity Mean (std)	Congestive Heart Failure Severity Score Mean (std)
Long term care Age 85 and over n = 146	1.2 (1.1)	7.6 (3.5)
Home care at home Age 85 and over n = 1,080	0.8 (0.9)	7.3 (3.1)
No home care at home Age 85 and over n = 705	0.9 (0.9)	7.4 (3.5)
Long term care Age 75 to 84 n = 101	1.3 (1.0)	6.1 (2.1)
Home care at home Age 75 to 84 n = 1,072	1.2 (1.0)	6.6 (3.0)
No home care at home Age 75 to 84 n = 1,726	1.0 (1.0)	6.3 (3.1)
Long term care Age 65 to 74 n = 30	1.5 (1.4)	5.2 (2.4)
Home care at home Age 65 to 74 n = 423	1.4 (1.1)	5.8 (3.0)
No home care at home Age 65 to 74 n = 1,302	1.1 (1.0)	5.5 (3.1)

By ANOVA Severity Increased With Age ($p < 0.001$) and Comorbidity was Greater in Those Residing in Long Term Care ($p < 0.001$).

Table 5 – Providers of Home Care in Those Hospitalized With Newly Diagnosed Congestive Heart Failure in Alberta During 1995/1996 to 1999/2000

Provider type for the 4,437 patients receiving home care prior to hospitalization (Number and percent of separations receiving home care)	Home care before hospitalization (Mean hours and dollars per patient)	Provider type for the 5,462 patients receiving home care after hospitalization (Number and percent of separations receiving home care)	Home care after hospitalization (Mean for hours and dollars per patient)
Home support aide Patients = 2,608 (58.8 %)	27.4 hours $387	Home support aide Patients = 2,709 (49.6 %)	27.9 hours $394
Nurse or licensed practical nurse Patients = 4,004 (90.2 %)	6.8 hours $201	Nurse or licensed practical nurse Patients = 5,103 (93.4 %)	7.4 hours $221
Respiratory therapist, occupational therapist, physiotherapist, social worker, or other health care professional Patients = 1,267 (28.6 %)	3.2 hours $105	Respiratory therapist, occupational therapist, physiotherapist, social worker, or other health care professional Patients = 1,762 (32.3 %)	3.3 hours $108
Other care Patients = 272 (6.1 %)	34.8 hours $459	Other care Patients = 324 (5.9 %)	30.6 hours $403
All types Patients = 4,437 Average hours and costs per patient	25.3 hours $467	All types Patients = 5,462 Average hours and costs per patient	23.6 hours $460

Table 6A – Unadjusted Outcomes (Number and Percent) for Those Hospitalized With Newly Diagnosed Congestive Heart in Alberta During 1995/1996 to 1999/2000

	Separations receiving home care before discharge n = 3,822	Separations receiving no home care before discharge n = 8,244	P	Separations receiving home care after discharge n = 5,462	Separations receiving no home care after discharge n = 6,604	P
Mean (std) length of stay in days [1]	12.7 (19.3)	8.3 (9.2)	0.000	11.4 (12.6)	8.2 (14.0)	0.000
In-hospital mortality; n (%)	615 (13.9 %)	602 (6.8 %)	0.000	N/A	N/A	
All cause sixty-day readmissions; n (%) [1]	475 (12.4 %)	839 (10.2 %)	0.000	776 (14.2 %)	538 (8.1 %)	0.000
One-year mortality; n (%) [1]	1,207 (31.6 %)	1,619 (20.2 %)	0.000	1,589 (29.1 %)	1,237 (19.4 %)	0.000
Hospital costs per separation (mean, std in dollars) [1]	$4,333	$4,485	0.007	$4,538	$4,354	0.001
Cost per patient per hospital day (mean in dollars) [1]	$779	$980	0.000	$768	$1,039	0.000

[1] Exclude in-hospital deaths.

Table 6B – Adjusted Outcome (Ninety-Five Percent Confidence Interval) for Those Hospitalized With Newly Diagnosed Congestive Heart Failure in Alberta During 1995/1996 to 1998/1999

	Separations receiving home care before discharge n = 3,822	Separations receiving no home care before discharge n = 8,244	Separations receiving home care after discharge n = 5,462	Separations receiving no home care after discharge n = 6,604
Length of stay (day) [1]	12.1 (11.6, 12.5)	8.6 (8.3, 8.9)	10.7 (10.3, 11.0)	8.8 (8.5, 9.2)
Sixty-day readmissions (percent) [1]	12.0 (11.1, 13.0)	10.3 (9.7, 11.0)	13.9 (13.1, 14.7)	8.3 (7.5, 9.1)
In-hospital mortality (percent)	10.8 (10.1, 11.5)	8.0 (7.4, 8.6)	N/A	N/A
One-year mortality (percent) [1]	26.8 (25.6, 28.0)	22.0 (21.0, 22.9)	26.0 (25.0, 27.0)	21.4 (20.4, 22.5)
Cost per patient per hospital day (dollars) [1]	$817 (785, 849)	$963 (941, 984)	$804 (777, 831)	$1,010 (986, 1,034)
Hospital costs per separation (dollars) [1]	$4,430 (4,336, 4,524)	$4,441 (4,378, 4,503)	$4,533 (4,455, 4,610)	$4,359 (4,288, 4,429)

[1] Exclude in-hospital death

APPENDIX

Table A – Separations Receiving Home Care or no Home Care Before or After Discharge by Service Region

Service region	Separations receiving home care before discharge	Separations receiving no home care before discharge	Separations receiving home care after discharge	Separations receiving no home care after discharge
1	331 (7.5 %)	699 (7.9 %)	411 (7.5 %)	526 (8.0 %)
2	175 (3.9 %)	445 (5.0 %)	184 (3.4 %)	365 (5.5 %)
3	167 (3.8 %)	199 (2.2 %)	184 (3.4 %)	147 (2.2 %)
4	875 (19.7 %)	2,069 (23.4 %)	1,256 (23.0 %)	1,457 (22.1 %)
5	152 (3.4 %)	289 (3.3 %)	182 (3.3 %)	226 (3.4 %)
6	355 (8.0 %)	728 (8.2 %)	437 (8.0 %)	553 (8.4 %)
7	379 (8.5 %)	531 (6.0 %)	427 (7.8 %)	387 (5.9 %)
8	91 (2.1 %)	166 (1.9 %)	113 (2.1 %)	127 (1.9 %)
9	105 (2.4 %)	252 (2.8 %)	123 (2.3 %)	216 (3.3 %)
10	935 (21.1 %)	2,074 (23.4 %)	1,211 (22.2 %)	1,470 (22.3 %)
11	203 (4.6 %)	242 (2.7 %)	207 (3.8 %)	193 (2.9 %)
12	323 (7.3 %)	526 (5.9 %)	356 (6.5 %)	423 (6.4 %)
13	191 (4.3 %)	277 (3.1 %)	197 (3.6 %)	226 (3.4 %)
14	60 (1.4 %)	126 (1.4 %)	68 (1.2 %)	100 (1.5 %)
15	38 (0.9 %)	105 (1.2 %)	45 (.8 %)	90 (1.4 %)
16	31 (0.7 %)	68 (0.8 %)	32 (0.6 %)	57 (0.9 %)
17	26 (0.6 %)	50 (0.6 %)	29 (0.5 %)	41 (0.6 %)
Alberta	**4,437 (100 %)**	**8,846 (100 %)**	**5,462 (100 %)**	**6,604 (100 %)**

Table B – Separations Receiving Home Care or no Home Care Before or After Discharge by Resident Region

Resident region	Separations receiving home care before discharge n (%)	Separations receiving no home care before discharge n (%)	Separations receiving home care after discharge n (%)	Separations receiving no home care after discharge n (%)
1	330 (7.4 %)	707 (8.0 %)	410 (7.5 %)	532 (8.1 %)
2	176 (4.0 %)	464 (5.2 %)	187 (3.4 %)	380 (5.8 %)
3	186 (4.2 %)	247 (2.8 %)	210 (3.8 %)	185 (2.8 %)
4	855 (19.3 %)	1,945 (22.0 %)	1,219 (22.3 %)	1,363 (20.6 %)
5	141 (3.2 %)	299 (3.4 %)	172 (3.1 %)	234 (3.5 %)
6	361 (8.1%)	785 (8.9 %)	448 (8.2 %)	600 (9.1 %)
7	389 (8.8 %)	558 (6.3 %)	446 (8.2 %)	402 (6.1 %)
8	111 (2.5 %)	238 (2.7 %)	143 (2.6 %)	181 (2.7 %)
9	93 (2.1 %)	224 (2.5 %)	121 (2.2 %)	179 (2.7 %)
10	862 (19.4 %)	1,871 (21.2 %)	1,093 (20.0 %)	1,330 (20.1 %)
11	238 (5.4 %)	277 (3.1 %)	243 (4.4 %)	221 (3.3 %)
12	342 (7.7 %)	591 (6.7 %)	388 (7.1 %)	473 (7.2 %)
13	193 (4.3 %)	276 (3.1 %)	202 (3.7 %)	222 (3.4 %)
14	60 (1.4 %)	116 (1.3 %)	67 (1.2 %)	91 (1.4 %)
15	41 (0.9 %)	119 (1.3 %)	47 (0.9 %)	105 (1.6 %)
16	32 (0.7 %)	73 (0.8 %)	34 (0.6 %)	61 (0.9 %)
17	27 (0.6 %)	56 (0.6 %)	32 (0.6 %)	45 (0.7 %)
Alberta	**4,437 (100 %)**	**8,846 (100 %)**	**5,462 (100 %)**	**6,604 (1 %)**

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